



Southeast Shoreline Watershed Summary

Fenger Brook

WATERSHED DESCRIPTION AND MAPS

The Southeast Shoreline watershed covers an area of approximately 27,390 acres in the southern coastal area of Connecticut (Figure 1). There are several towns located at least partially in the watershed, including the municipalities of New London and Waterford, CT.

The Southeast Shoreline watershed includes one segment addressed in this TMDL impaired for recreation due to elevated bacteria levels, Fenger Brook (CT2000-30_01). This segment was assessed by Connecticut Department of Energy and Environmental Protection (CT DEEP) and included in the CT 2010 303(d) list of impaired waterbodies. An excerpt of the Integrated Water Quality Report is included in Table 1 to show the status of the waterbodies in the watershed (CT DEEP, 2010).

The bacteria impaired segment (CT2000-30_01) consists of the entire length of Fenger Brook. Fenger Brook begins south of the intersection of Clark Lane and Chester Street in Waterford near the Waterford-New London town line, meanders through a large forested area along the Waterford-New London town line, passes under Route 1 in Waterford, and empties into Alewife Cove just downstream of Niles Hill Road on the Waterford-New London town line. The segment is 3.47 miles long and is located within the City of New London and the Town of Waterford.

The impaired segment of the Southeast Shoreline watershed, Fenger Brook, has a water quality classification of A. Designated uses are potential drinking water supplies, habitat for fish and other aquatic life and wildlife, recreation, navigation, and industrial and agricultural water supply. This segment of the river is impaired due to elevated bacteria concentrations, affecting the designated use of recreation. As there are no designated beaches in this segment of Fenger Brook, the specific recreation impairment is for non-designated swimming and other water contact related activities.

Impaired Segment Facts

Impaired Segment:

Fenger Brook (CT2000-30_01)

Municipalities:

New London and Waterford

Impaired Segment Length (miles):

3.47

Water Quality Classification:

Class A

Designated Use Impairment:

Recreation

Sub-regional Basin Name and

Code: Southeast Shoreline, 2000

Regional Basin: Southeast Shoreline

Major Basin: Southeast Coast

Watershed Area (acres): 27,390

MS4 Applicable: Yes

Applicable Season: Recreation
Season (May 1 to September 30)

Figure 1: Watershed location in Connecticut

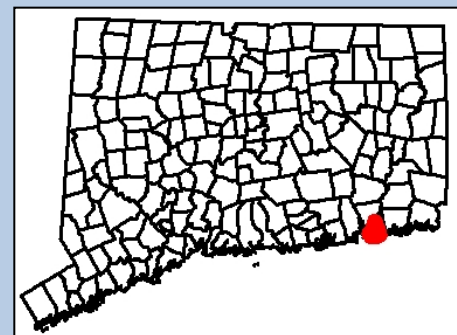
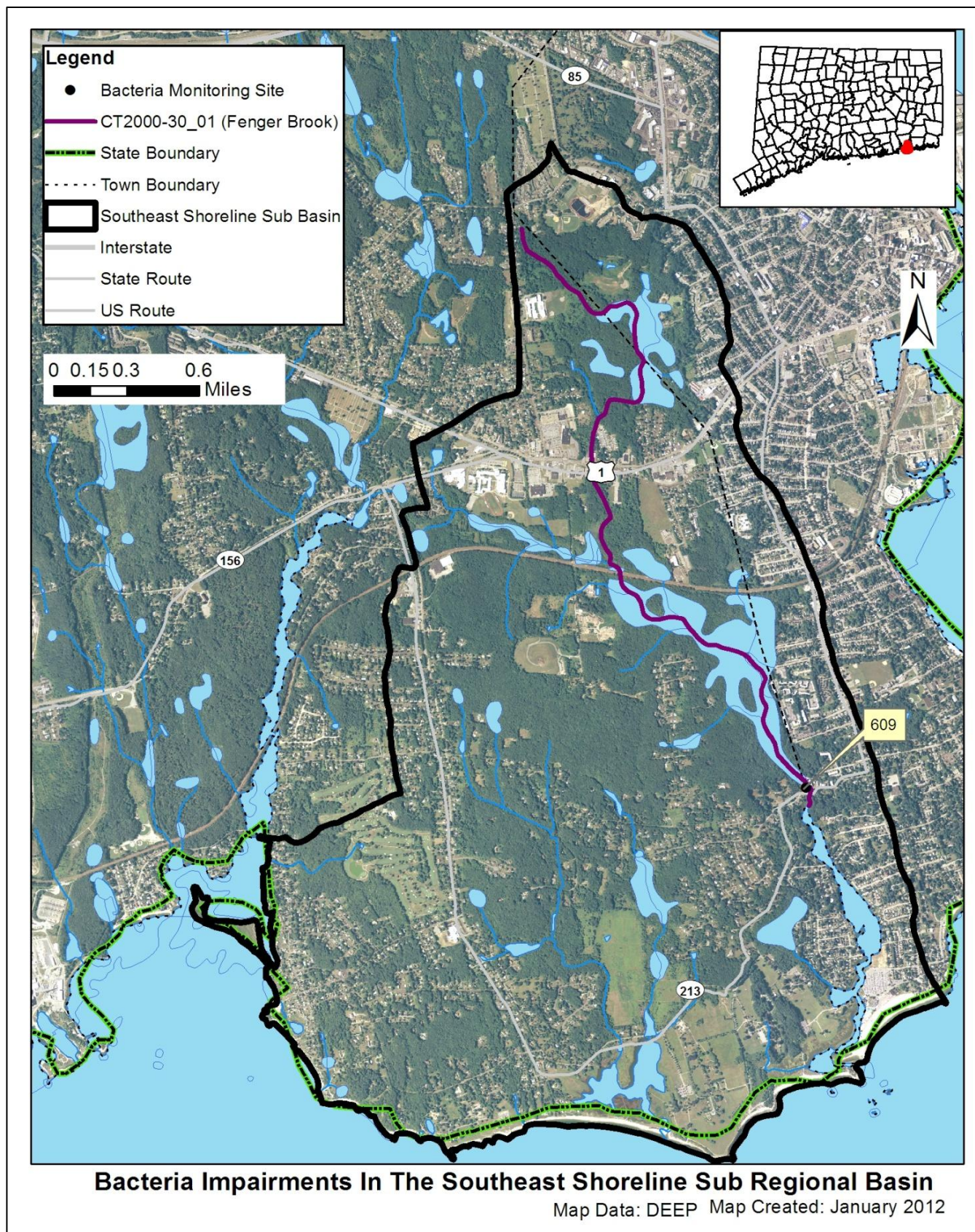


Table 1: Impaired segment and nearby waterbodies from the Connecticut 2010 Integrated Water Quality Report

Waterbody ID	Waterbody Name	Location	Miles	Aquatic Life	Recreation	Fish Consumption
CT2000-30_01	Fenger Brook-01	From mouth at head of tide, Alewife Cove (just DS of Niles Hill Road (Route 213) crossing), US to headwaters (southeast of Clark Lane and Chester Street intersection), Waterford.	3.47	NOT	NOT	FULL
FULL = Designated Use Fully Supported NOT = Designated Use Not Supported U = Unassessed						

Figure 2: GIS map featuring general information of the Southeast Shoreline watershed at the sub-regional level

Land Use

Existing land use can affect the water quality of waterbodies within a watershed (USEPA, 2011c). Natural processes, such as soil infiltration of stormwater and plant uptake of water and nutrients, can occur in undeveloped portions of the watershed. As impervious surfaces (such as rooftops, roads, and sidewalks) increase within the watershed landscape from commercial, residential, and industrial development, the amount of stormwater runoff to waterbodies also increases. These waterbodies are negatively affected as increased pollutants from nutrients and bacteria from failing and insufficient septic systems, oil and grease from automobiles, and sediment from construction activities become entrained in this runoff. Agricultural land use activities, such as fertilizer application and manure from livestock, can also increase pollutants in nearby waterbodies (USEPA, 2011c).

As shown in Figures 3 and 4, the Southeast Shoreline watershed consists of 41% urban area, 42% forest, 5% agriculture, and 12% water. The land use presented in Figure 3 represents the entire Southeast Shoreline watershed, while Figure 4 represents the watershed surrounding Fenger Brook. The majority of the watershed surrounding the impaired segment is a mix of water, urban, and forested land uses. Although there is some agricultural land use indicated near the impaired segment, those areas did not appear to show agricultural activity in recent aerial photos. The more developed portions of the watershed are along Clark Lane and US Route 1 in Waterford as well as US Route 1 and Jefferson Avenue in New London. (Figure 4).

Figure 3: Land use within the Southeast Shoreline watershed

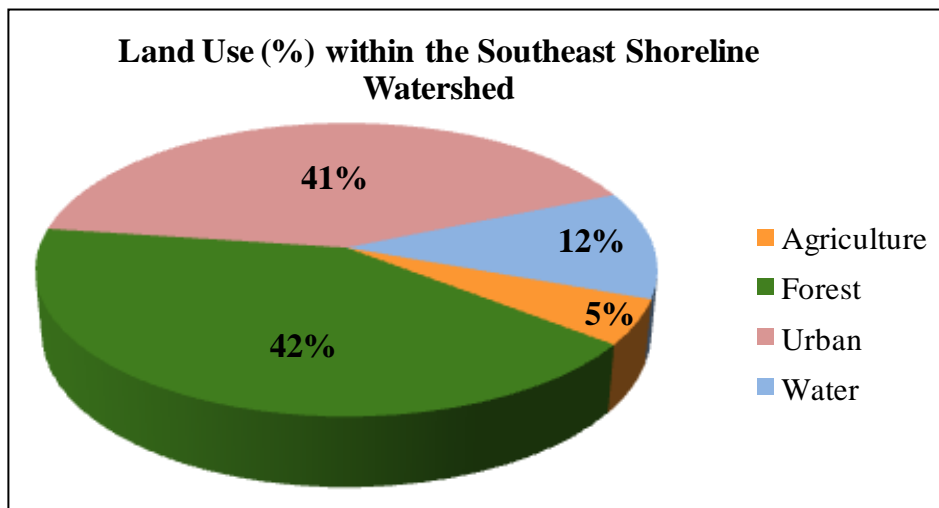
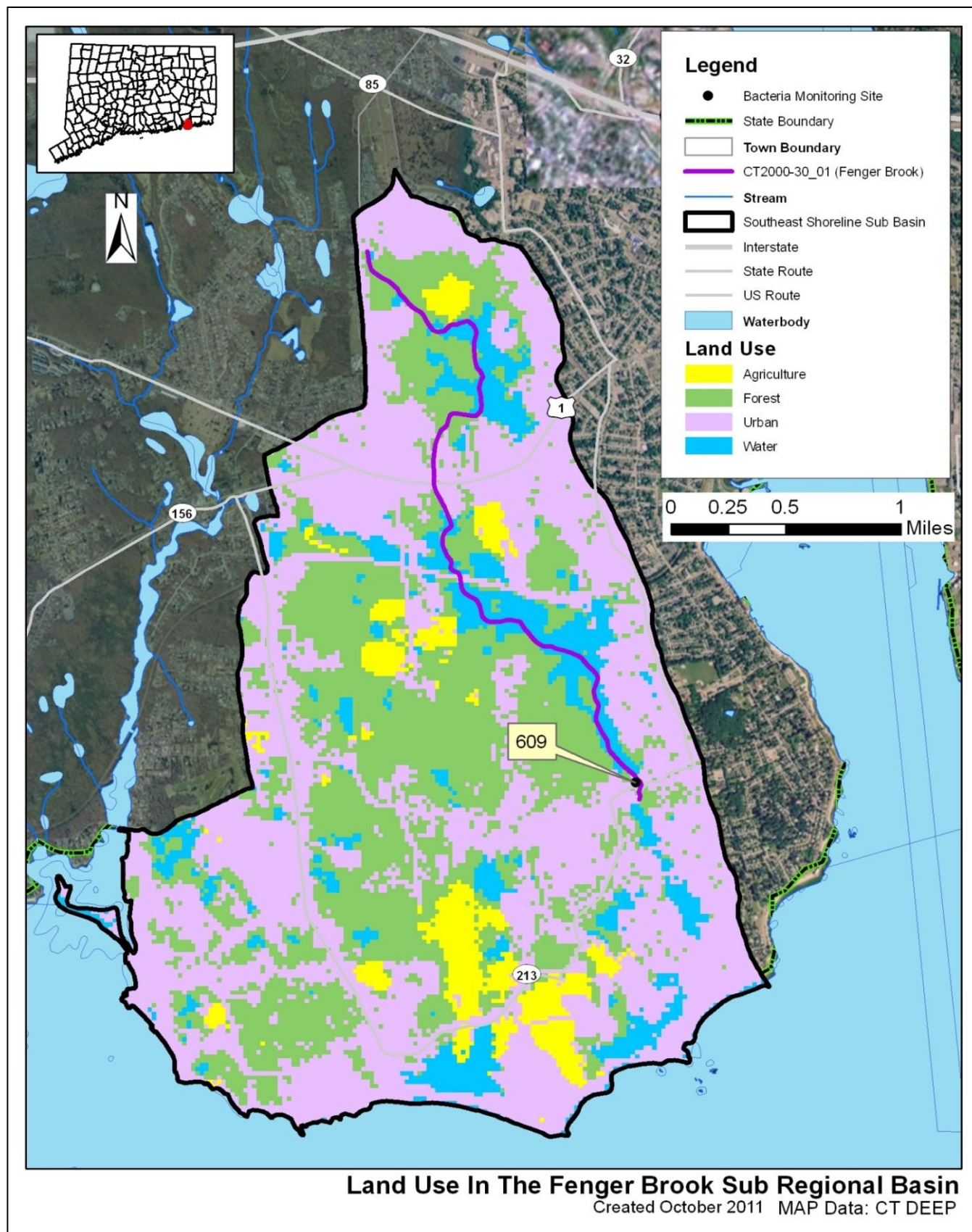


Figure 4: GIS map featuring land use for the Southeast Shoreline watershed at the sub-regional level



WHY IS A TMDL NEEDED?

E. coli is the indicator bacteria used for comparison with the CT State criteria in the CT Water Quality Standards (WQS) (CTDEEP, 2011). All data results are from CT DEEP, USGS, Bureau of Aquaculture, or volunteer monitoring efforts at stations located on the impaired segments.

Table 2: Sampling station location description for the impaired segment in the Southeast Shoreline watershed (stations organized downstream to upstream)

Waterbody ID	Waterbody Name	Station	Station Description	Municipality	Latitude	Longitude
CT2000-30_01	Fenger Brook	609	Route 213 and 3 foot stone dam	New London	41.321919	-72.105439

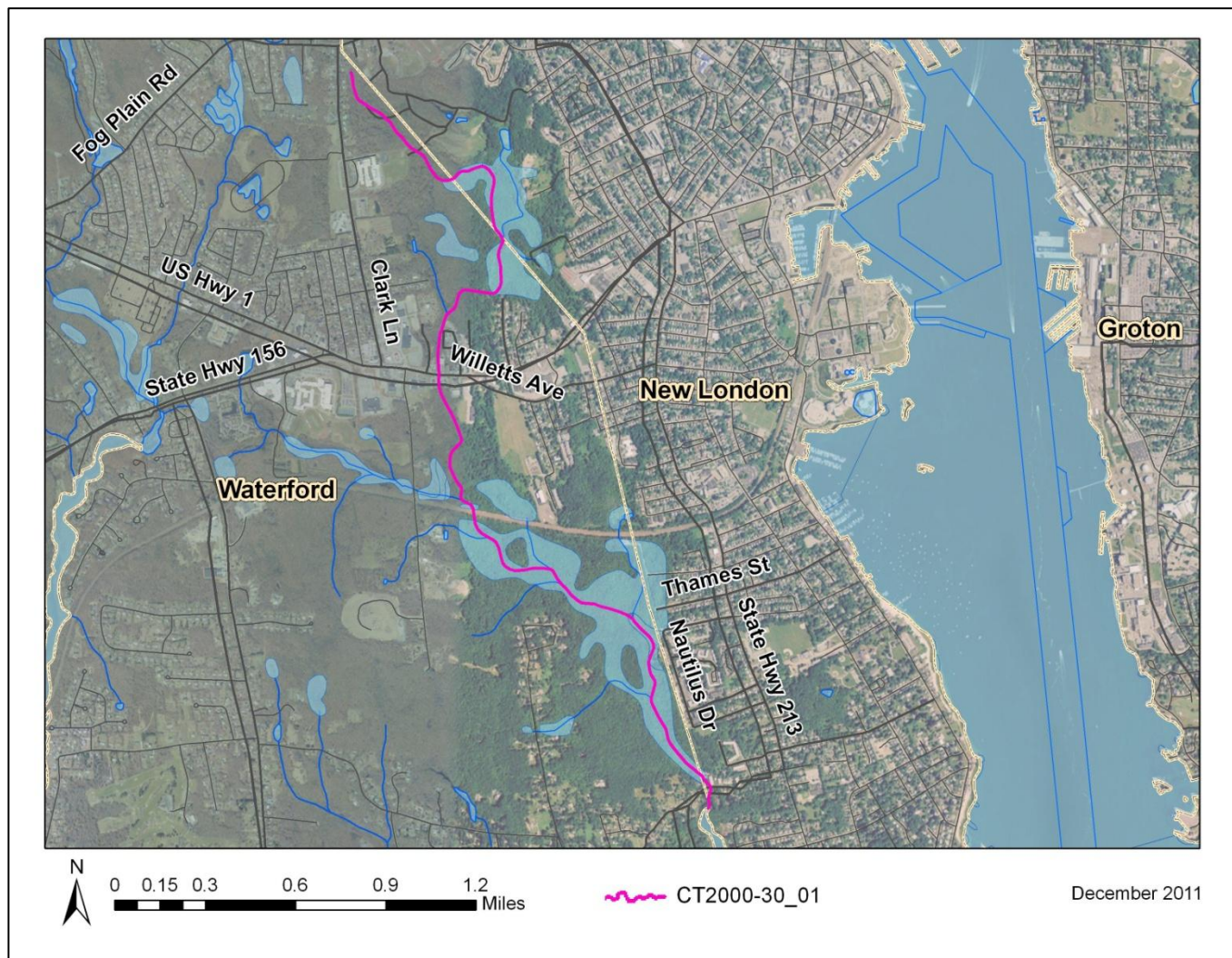
Fenger Brook's impaired segment (CT2000-30_01) is a Class A freshwater brook (Figure 5). Its applicable designated uses are potential drinking water supplies, habitat for fish and other aquatic life and wildlife, recreation, and industrial and agricultural water supply. Water quality analyses were conducted using data from one sampling location, Station 609, from 2000-2001 (Table 2).

The water quality criteria for *E. coli*, along with bacteria sampling results from 2000-2001, are presented in Table 9. The annual geometric mean was calculated for Station 609 and exceeded the WQS for *E. coli* in 2001. Single sample values at this station also exceeded the WQS for *E. coli* on one day in 2001.

To aid in identifying possible bacteria sources, the geometric mean was also calculated for Station 609 for wet-weather and dry-weather sampling days, where appropriate (Table 9). For Fenger Brook, the geometric mean during dry-weather exceeded the WQS for *E. coli* at Station 609. The geometric mean during wet-weather could not be calculated due to insufficient data.

Due to the elevated bacteria measurements presented in Table 9, this segment of Fenger Brook did not meet CT's bacteria WQS, was identified as impaired, and was placed on the CT List of Waterbodies Not Meeting Water Quality Standards, also known as the CT 303(d) Impaired Waters List. The Clean Water Act requires that all 303(d) listed waters undergo a TMDL assessment that describes the impairments and identifies the measures needed to restore water quality. The goal is for all waterbodies to comply with State WQS.

Figure 5: Aerial map of the impaired segment of Fenger Brook



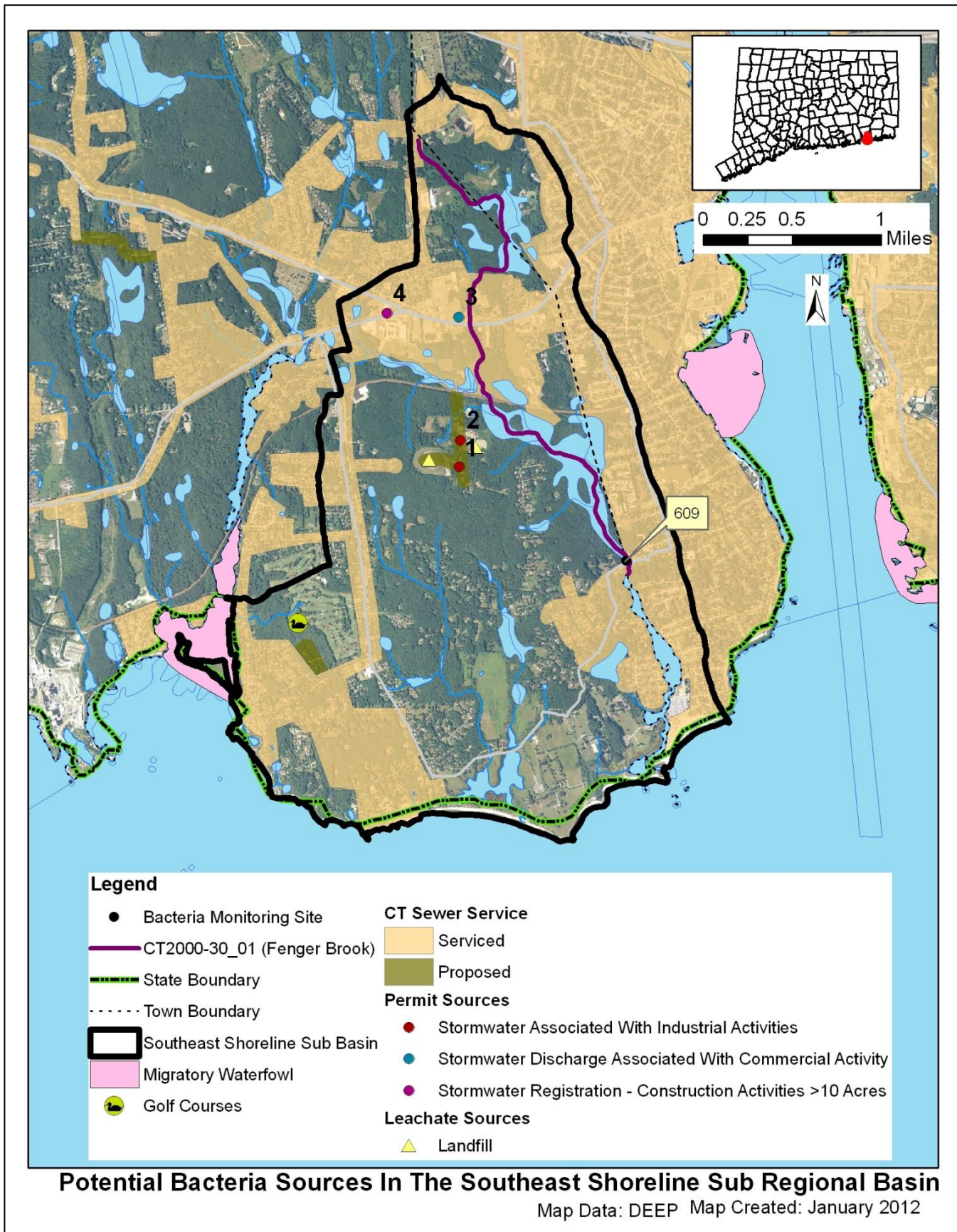
POTENTIAL BACTERIA SOURCES

Potential sources of indicator bacteria in a watershed include point and non-point sources, such as stormwater runoff, agriculture, sanitary sewer overflows (collection system failures), illicit discharges, and inappropriate discharges to the waterbody. Potential sources that have been tentatively identified in the watershed based on land use (Figures 3 and 4) and a collection of local information for the impaired waterbody is presented in Table 3 and Figure 6. However, the list of potential sources is general in nature and should not be considered comprehensive. There may be other sources not listed here that contribute to the observed water quality impairment in the study segments. Further monitoring and investigation will confirm listed sources and discover additional ones. Some segments in this watershed are currently listed as unassessed by CT DEEP procedures. This does not suggest that there are no potential issues on this segment, but indicates a lack of current data to evaluate the segment as part of the assessment process. For some segments, there are data from permitted sources, and CT DEEP recommends that any elevated concentrations found from those permitted sources be addressed through voluntary reduction measures. More detailed evaluation of potential sources is expected to become available as activities are conducted to implement these TMDLs.

Table 3: Potential bacteria sources in the Southeast Shoreline watershed

Impaired Segment	Permit Source	Illicit Discharge	CSO/SSO Issue	Failing Septic System	Agricultural Activity	Stormwater Runoff	Nuisance Wildlife/Pets	Other
Fenger Brook CT2000-30_01	x	x		x		x	x	

Figure 6: Potential sources in the Southeast Shoreline watershed at the sub-regional level



The potential sources map for the impaired basin was developed after thorough analysis of available data sets. If information is not displayed in the map, then no sources were discovered during the analysis. The following is the list of potential sources that were evaluated: problems with migratory waterfowl, golf course locations, reservoirs, proposed and existing sewer service, cattle farms, poultry farms, permitted sources of bacteria loading (surface water discharge, MS4 permit, industrial stormwater, commercial stormwater, groundwater permits, and construction related stormwater), and leachate and discharge sources (agricultural waste, CSOs, failing septic systems, landfills, large septic tank leach fields, septage lagoons, sewage treatment plants, and water treatment or filter backwash).

Point Sources

Permitted sources within the watershed that could potentially contribute to the bacteria loading are identified in Table 4. This table includes permit types that may or may not be present in the impaired watershed. A list of active permits in the watershed is included in Table 5. Additional investigation and monitoring could reveal the presence of additional discharges in the watershed. Available effluent data from each of these permitted categories found within the watershed are compared to the CT State WQS for the appropriate receiving waterbody use and type.

Table 4: General categories list of other permitted discharges

Permit Code	Permit Description Type	Number in watershed
CT	Surface Water Discharges	0
GPL	Discharge of Swimming Pool Wastewater	0
GSC	Stormwater Discharge Associated with Commercial Activity	1
GSI	Stormwater Associated with Industrial Activity	2
GSM	Part B Municipal Stormwater MS4	2
GSN	Stormwater Registration – Construction	1
LF	Groundwater Permit (Landfill)	0
UI	Underground Injection	0

Permitted Sources

As shown in Table 5, there are multiple permitted discharges in the Southeast Shoreline watershed. Bacteria data from these permitted facilities is not available. While no data exists for these discharges, they may be a potential source of bacterial contamination to Fenger Brook. Since the MS4 permits are not targeted to a specific location, but the geographic area of the regulated municipality, there is no one accurate location on the map to display the location of these permits. One dot will be displayed at the geographic center of the municipality as a reference point. Sometimes this location falls outside of the targeted watershed and therefore the MS4 permit will not be displayed in the Potential Sources Map. Using the municipal border as a guideline will show which areas of an affected watershed are covered by an MS4 permit.

Table 5: Permitted facilities within the Southeast Shoreline watershed

Town	Client	Permit ID	Permit Type	Site Name	Address	Map #
New London	Southeast Shoreline	GSM000111	Part B Municipal Stormwater MS4	City of New London	-	NA
Waterford	Southeast Shoreline	GSM000023	Part B Municipal Stormwater MS4	Town of Waterford	-	NA
Waterford	Southeast Shoreline	GSI001409	Stormwater Associated With Industrial Activities	Waterford Bulky Waste Landfill	85 Miner Ln	1
Waterford	Southeast Shoreline	GSI001985	Stormwater Associated With Industrial Activities	Murphy Road Recycling Llc	56 Miner Ln	2
Waterford	Southeast Shoreline	GSC000343	Stormwater Discharge Associated With Commercial Activity	Waterford & Miner Llc	104-106 Boston Post Road & 22 Miner Lane	3
Waterford	Southeast Shoreline	GSN002151	Stormwater Registration - Construction Activities >10 Acres	Waterford High School	20 Rope Ferry Rd	4

Municipal Stormwater Permitted Sources

Per the EPA Phase II Stormwater rule all municipal storm sewer systems (MS4s) operators located within US Census Bureau Urbanized Areas (UAs) must be covered under MS4 permits regulated by the appropriate State agency. There is an EPA waiver process that municipalities can apply for to not participate in the MS4 program. In Connecticut, EPA has granted such waivers to 19 municipalities. All participating municipalities within UAs in Connecticut are currently regulated under MS4 permits by CT DEEP staff in the MS4 program.

The US Census Bureau defines a UA as a densely settled area that has a census population of at least 50,000. A UA generally consists of a geographic core of block groups or blocks that exceeds the 50,000 people threshold and has a population density of at least 1,000 people per square mile. The UA will also include adjacent block groups and blocks with at least 500 people per square mile. A UA consists of all or part of one or more incorporated places and/or census designated places, and may include additional territory outside of any place. (67 FR 11663)

For the 2000 Census a new geographic entity was created to supplement the UA blocks of land. This created a block known as an Urban Cluster (UC) and is slightly different than the UA. The definition of a UC is a densely settled area that has a census population of 2,500 to 49,999. A UC generally consists of a geographic core of block groups or blocks that have a population density of at least 1,000 people per square mile, and adjacent block groups and blocks with at least 500 people per square mile. A UC consists of all or part of one or more incorporated places and/or census designated places; such a place(s) together with adjacent territory; or territory outside of any place. The major difference is the total population cap of 49,999 people for a UC compared to >50,000 people for a UA. (67 FR 11663)

While it is possible that CT DEEP will be expanding the reach of the MS4 program to include UC municipalities in the near future they are not currently under the permit. However, the GIS layers used to create the MS4 maps in this Statewide TMDL did include both UA and UC blocks. This factor creates some municipalities that appear to be within an MS4 program that are not currently regulated through an MS4 permit. This oversight can explain a municipality that is at least partially shaded grey in the maps and there are no active MS4 reporting materials or information included in the appropriate appendix. While these areas are not technically in the MS4 permit program, they are still considered urban by the cluster definition above and are likely to contribute similar stormwater discharges to affected waterbodies covered in this TMDL.

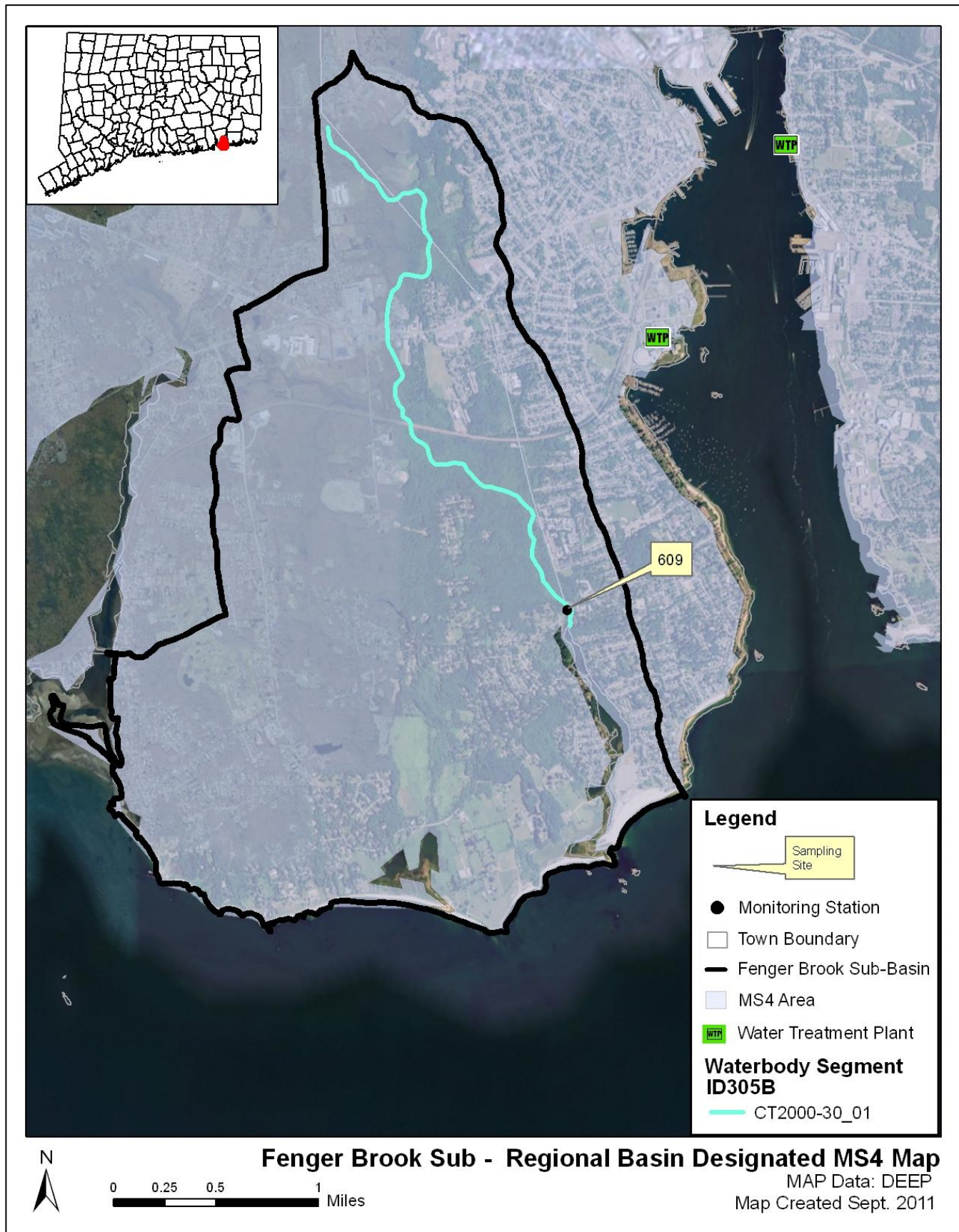
As previously noted, EPA can grant a waiver to a municipality to preclude their inclusion in the MS4 permit program. One reason a waiver could be granted is a municipality with a total population less than 1000 people, even if the municipality was located in a UA. There are 19 municipalities in Connecticut that have received waivers, this list is: Andover, Bozrah, Canterbury, Coventry, East Hampton, Franklin, Haddam, Killingworth, Litchfield, Lyme, New Hartford, Plainfield, Preston, Salem, Sherman, Sprague, Stafford, Washington, and Woodstock. There will be no MS4 reporting documents from these towns even if they are displayed in an MS4 area in the maps of this document.

The list of US Census UCs is defined by geographic regions and is named for those regions, not necessarily by following municipal borders. In Connecticut the list of UCs includes blocks in the following Census Bureau regions: Colchester, Danielson, Lake Pocotopaug, Plainfield, Stafford, Storrs, Torrington, Willimantic, Winsted, and the border area with Westerly, RI (67 FR 11663). Any MS4 maps showing these municipalities may show grey areas that are not currently regulated by the CT DEEP MS4 permit program.

The impaired segment of the Southeast Shoreline watershed is located within the Town of Waterford and City of New London. Both of these municipalities have designated urban areas, as defined by the U.S. Census Bureau, and are required to comply with the General Permit for the Discharge of Stormwater from Small Municipal Storm Sewer Systems (MS4 permit) issued by the Connecticut Department of Energy and Environmental Protection (DEEP) (Figure 7). This general permit is only applicable to municipalities that are identified in Appendix A of the MS4 permit that contain designated urban areas and discharge stormwater via a separate storm sewer system to surface waters of the State. The permit required municipalities to develop a Stormwater Management Plan (SMP) to reduce the discharge of pollutants as well as to protect water quality. The MS4 permit is discussed further in the "TMDL Implementation Guidance" section of the core TMDL document. Additional information regarding stormwater management and the MS4 permit can be obtained on CTDEEP's website

(http://www.ct.gov/dep/cwp/view.asp?a=2721&q=325702&depNav_GID=1654).

Figure 7: MS4 areas of the Southeast Shoreline watershed



Non-point Sources

Non-point source pollution (NPS) comes from many diffuse sources and is more difficult to identify and control. NPS pollution is often associated with land-use practices. Examples of NPS that can contribute bacteria to surface waters include insufficient septic systems, pet and wildlife waste, agriculture, and contact recreation (swimming or wading). Potential sources of NPS within the Southeast Shoreline watershed are described below.

Stormwater Runoff from Developed Areas

There is a considerable amount of development near Fenger Brook in the Southeast Shoreline watershed. Approximately 41% of the watershed is considered urban, and much of that area is concentrated around the impaired segment in the City of New London and Town of Waterford (Figures 4 and 9). Urban areas are often characterized by impervious cover, or surface areas such as roofs and roads that force water to run off land surfaces rather than infiltrate into the soil. Studies have shown a link between increasing impervious cover and degrading water quality conditions in a watershed (CWP, 2003). In one study, researchers correlated the amount of fecal coliform to the percent of impervious cover in a watershed (Mallin *et al.*, 2000).

The majority (86%) of the Southeast Shoreline watershed is characterized by >16% impervious cover, while 11% is 12 to 15% impervious cover and 3% is 7 to 11% impervious (Figure 8). The entire area surrounding the impaired segment is characterized by >16% impervious cover. The impervious cover percentages presented in Figure 8 are derived from the greater Southeast Shoreline watershed, while Figure 9 only shows the impervious surface percentages in the areas of the watershed closest to the impaired segment.

Figure 8: Range of impervious cover (%) in the Southeast Shoreline watershed

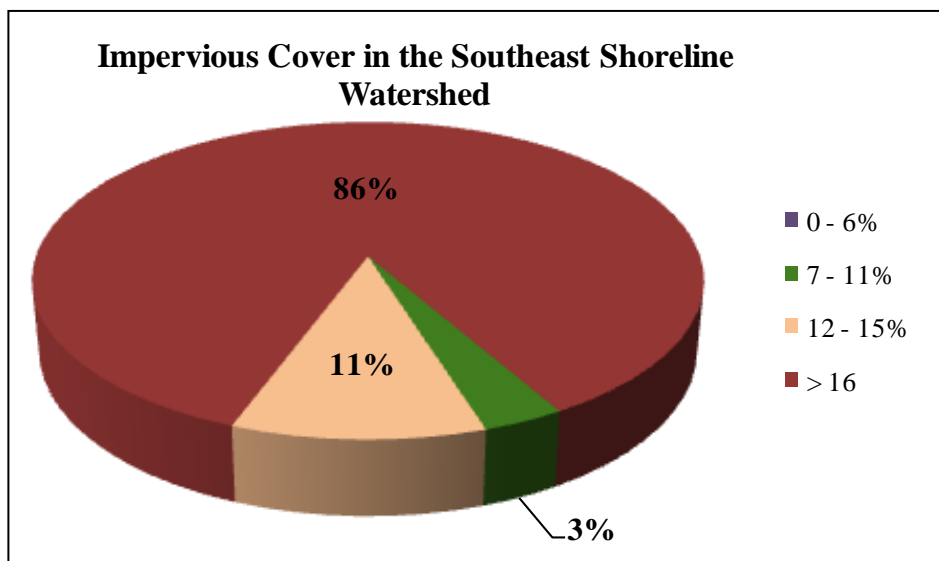
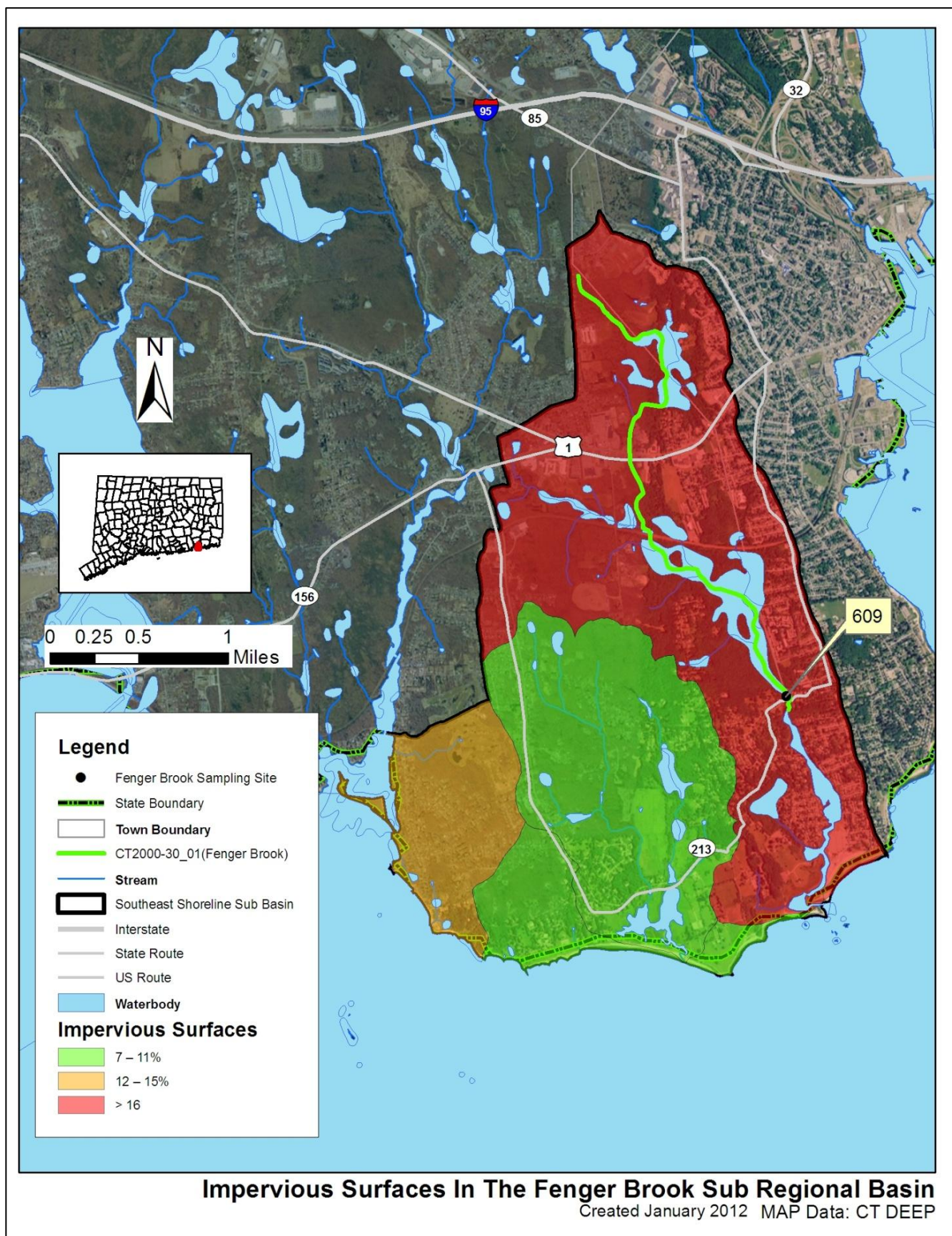


Figure 9: Impervious cover (%) for Fenger Brook sub-regional watershed



Insufficient Septic Systems and Illicit Discharges

As shown in Figure 6, some sections of the watershed are serviced by sanitary sewers. The large residential development off Pepperbox Road in Waterford is near the brook and has no access to a sanitary sewer. Households and businesses in non-serviced areas of the watershed must rely on onsite wastewater treatment systems, such as septic systems. There may be undetected failed septic systems in the watershed. Insufficient or failing septic systems can be significant sources of bacteria by allowing raw waste to reach surface waters. In Connecticut, local health directors or health districts are responsible for keeping track of any reported insufficient or failing septic systems in a specific municipality. The Town of Waterford and City of New London are part of the Ledge Light Health District (<http://www.ledgelighthd.org/>) which handles insufficient or failing septic systems in East Lyme, Groton, Ledyard, New London, and Waterford.

There are several areas in the watershed that Fenger Brook flows through or flows adjacent to that are serviced by a sanitary sewer. Sewer system leaks and other illicit discharges that are located within the Southeast Shoreline watershed near Fenger Brook may be contributing bacteria to the waterbody.

Wildlife and Domestic Animal Waste

Wildlife and domestic animals within the Southeast Shoreline watershed represent another potential source of bacteria to Fenger Brook. With the construction of roads and drainage systems, these wastes may no longer be retained on the landscape, but instead may be conveyed via stormwater to the nearest surface water. These physical land alterations can exacerbate the impact of natural sources on water quality (USEPA, 2001).

Geese and other waterfowl are known to congregate in open areas including recreational fields, golf courses, agricultural crop fields, and ponds. There are several recreational fields in proximity to Fenger Brook. The New London High School recreational fields are located near the headwaters of Fenger Brook off Chester Street in New London. The Clark Lane Jr. High School recreational fields are also located near the impaired segment off Clark Lane in Waterford. The Southeast Shoreline watershed is comprised of 12% surface water. The small ponds and wetland areas in the watershed and along Fenger Brook can provide areas for geese and other waterfowl to congregate. As shown in Figure 6, there are multiple areas throughout the watershed that are frequented by migratory waterfowl. In addition to creating a nuisance, large numbers of geese can also create unsanitary conditions on the grassed areas and ponds and cause water quality problems due to bacterial contamination associated with their droppings. Large populations of geese can also lead to habitat destruction as a result of overgrazing on wetland and riparian plants.

Also, urban development surrounds portions of Fenger Brook (Figure 5). When not disposed properly, waste from domestic animals such as dogs, can enter surface waters directly or through stormwater infrastructure. Therefore, domestic animal waste may also be contributing to bacteria concentrations in Fenger Brook.

Additional Sources

There may be other sources not listed here or identified in Figure 6 that contribute to the observed water quality impairment in Fenger Brook. Further monitoring and investigation will confirm the listed sources and discover additional ones. More detailed evaluation of potential sources is expected to become available as activities are conducted to implement this TMDL.

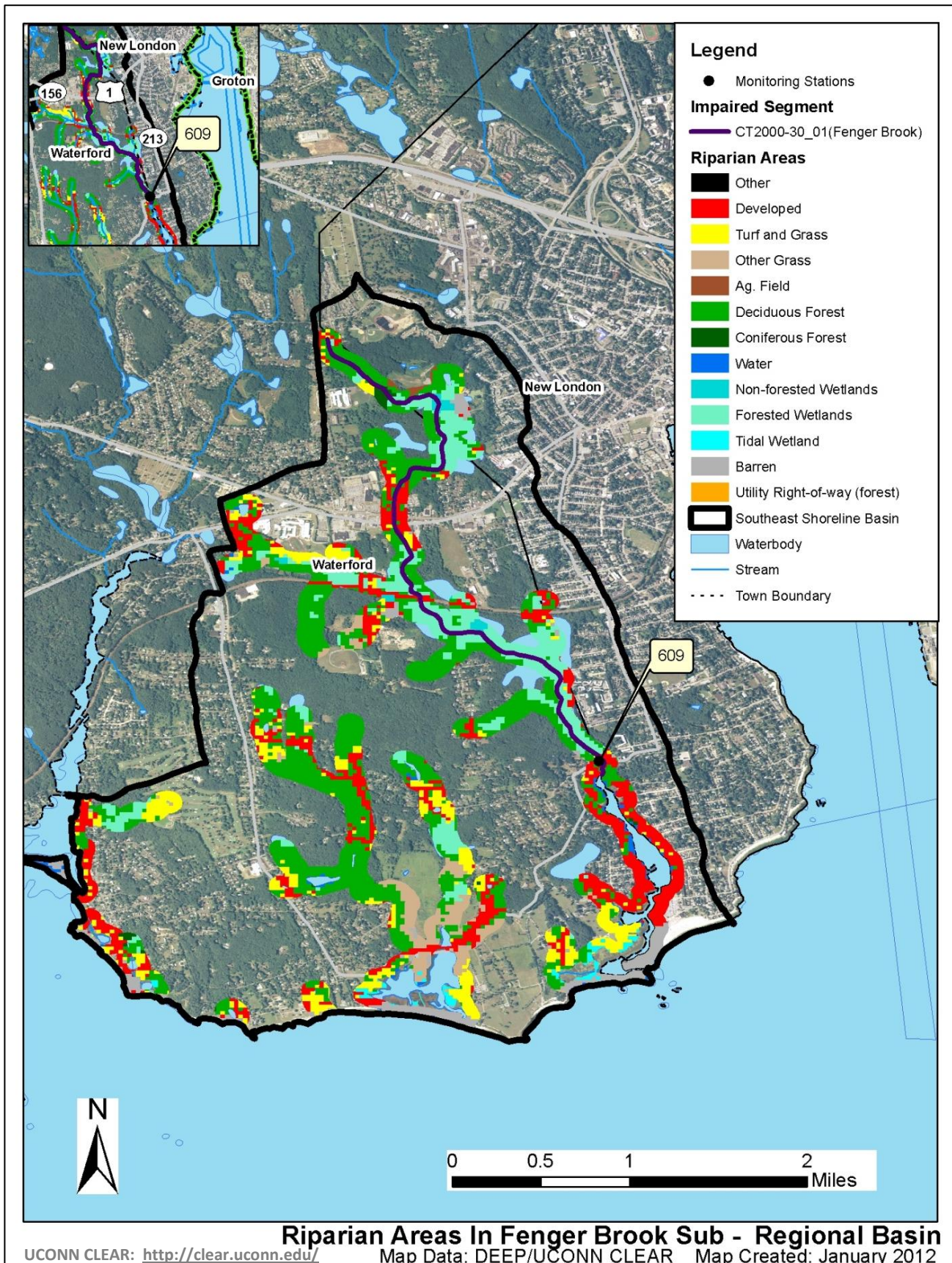
Land Use/Landscape***Riparian Buffer Zones***

The riparian buffer zone is the area of land located immediately adjacent to streams, lakes, or other surface waters. The boundary of the riparian zone and the adjoining uplands is gradual and not always well-defined. However, riparian zones differ from uplands because of high levels of soil moisture, frequent flooding, and the unique assemblage of plant and animal communities found there. Through the interaction of their soils, hydrology, and vegetation, natural riparian areas influence water quality as contaminants are taken up into plant tissues, adsorbed onto soil particles, or modified by soil organisms. Any change to the natural riparian buffer zone can reduce the effectiveness of the natural buffer and has the potential to contribute to water quality impairment (USEPA, 2011b).

The CLEAR program at UCONN has created streamside buffer layers for the entire State of Connecticut (<http://clear.uconn.edu/>), which have been used in this TMDL. Analyzing this information can reveal potential sources and implementation opportunities at a localized level. The land use directly adjacent to a waterbody can have direct impacts on water quality from surface runoff sources.

The riparian zone for Fenger Brook and other tributaries within the Southeast Shoreline watershed is characterized by forested, developed, turf grass and wetland land uses (Figure 10). Fenger Brook runs through several highly developed areas especially as it flows under US Route 1 in Waterford. As previously mentioned, developed areas are a potential source of bacterial contamination.

Figure 10: Riparian buffer zone information for the Southeast Shoreline watershed



CURRENT MANAGEMENT ACTIVITIES

In 1996, the Fenger Brook Watershed Management Study was developed to better characterize the Fenger Brook watershed. The report is mentioned on CT DEEP's website (http://www.ct.gov/dep/cwp/view.asp?a=2719&q=379296&depNav_GID=1654), but no link is provided.

The City of New London and Town of Waterford have developed and implemented programs to protect water quality from bacterial contamination. As indicated previously, both municipalities are regulated under the MS4 program. The MS4 General Permit is required for any municipality with urbanized areas that initiates, creates, originates or maintains any discharge of stormwater from a storm sewer system to waters of the State. The MS4 permit requires towns to design a Stormwater Management Plan (SMP) to reduce the discharge of pollutants in stormwater to improve water quality. The plan must address the following 6 minimum measures:

1. Public Education and Outreach.
2. Public Involvement/Participation.
3. Illicit discharge detection and elimination.
4. Construction site stormwater runoff control.
5. Post-construction stormwater management in the new development and redevelopment.
6. Pollution prevention/good housekeeping for municipal operations.

Each municipality is also required to submit an annual update outlining the steps they are taking to meet the six minimum measures. All updates that address bacterial contamination in the watershed are summarized in Tables 6 and 7.

Table 6: Summary of MS4 requirement updates related to the reduction of bacterial contamination from New London, CT (GSM000111)

Minimum Measure	New London 2010 Annual Report Update
Public Outreach and Education	1) The City has purchased 500 storm drain markers and has installed 45 markers in 2010.
Public Involvement and Participation	No updates
Illicit Discharge Detection and Elimination	No updates
Construction Site Stormwater Runoff Control	No updates
Post Construction Stormwater Management	No updates
Pollution Prevention and Good Housekeeping	1) The City has developed a program to evaluate and clean stormwater structures on an average of one time each year. In 2010 the City acquired a refurbished drain cleaner, which is used on a daily basis where needed.
	2) The Downtown district of New London is swept two times a week during the warm weather months.

Table 7: Summary of MS4 requirement updates related to the reduction of bacterial contamination from Waterford, CT (GSM000023)

Minimum Measure	Waterford 2010 Annual Report Update
Public Outreach and Education	1) The town has made the "Step by Step" educational brochure available to residents at the DPW office.
	2) The town has made links to the Stormwater Coalition website, their Stormwater Management Plan, and the General Stormwater Permit, available on their website.
Public Involvement and Participation	1) Meetings continue to be held to discuss LID and developers' plans for subdivisions.
Illicit Discharge Detection and Elimination	1) Six stormwater outlets were tested in 2010.
	2) The town responded to a sewer truck tank rupturing. Grey water was leaked into the storm system. The system was pumped out and road was cleaned with bleach to kill bacteria.
Construction Site Stormwater Runoff Control	1) The "Town of Waterford Stormwater Management Plan Fact Sheet" is distributed to developers, contractors, engineers, and the public at the Waterford Permitting office.
Post Construction Stormwater Management	No updates
Pollution Prevention and Good Housekeeping	1) Routine street sweeping was undertaken throughout the town.
	2) Catch basin cleaning work continued during 2010.

RECOMMENDED NEXT STEPS

As shown above, the City of New London and town of Waterford have developed and implemented programs to protect water quality from bacterial contamination. Future mitigative activities are necessary to ensure the long-term protection of Fenger Brook and have been prioritized below.

1) Identify areas along Fenger Brook to implement Best Management Practices (BMPs) to control stormwater runoff.

As noted previously, the City of New London and Town of Waterford within the Southeast Shoreline watershed are MS4 communities regulated by the MS4 program. Since 41% of the watershed is considered urban and developed areas are located near the impaired segment, stormwater runoff is likely contributing bacteria to the waterbody. To identify specific areas that are contributing bacteria to the impaired segment, Waterford and New London should conduct wet-weather sampling at stormwater outfalls that discharge directly to Fenger Brook. To treat stormwater runoff, the Waterford and New London should also identify areas along the more developed sections of Fenger Brook, particularly along the impaired segment, to install BMPs that encourage stormwater to infiltrate into the ground before entering Fenger Brook. These BMPs would disconnect impervious areas and reduce pollutant loads to the brooks. More detailed information and BMP recommendations can be found in the core TMDL document.

2) Implement a program to evaluate the sanitary sewer system.

Many businesses and households around Fenger Brook rely on a municipal sewer system (Figure 6). Ensuring there are no leaks or overflows from the sanitary sewer in this area should be a priority. Watershed has already begun testing six stormwater outfalls. It is important for New London and Waterford to continue to develop a program to evaluate its sanitary sewer and reduce leaks and overflows, especially in the areas around Fenger Brook. This program should include periodic inspections of the sewer line.

3) Develop a system to monitor septic systems.

Many residents in the watershed rely on septic systems (Figure 6). If not already in place, New London and Waterford should establish a program to ensure that existing septic systems are properly operated and maintained. For instance, communities can create an inventory of existing septic systems through mandatory inspections. Inspections help encourage proper maintenance and identify failed and sub-standard systems. Policies that govern the eventual replacement of the sub-standard systems within a reasonable timeframe could also be adopted. Towns can also develop programs to assist citizens with the replacement and repair of older and failing systems.

4) Evaluate municipal education and outreach programs regarding animal waste.

New London and Waterford can take measures to minimize waterfowl-related impacts such as encouraging residents and businesses to allow tall, coarse vegetation to grow in the riparian areas of Fenger Brook that are frequented by waterfowl, particularly within parks and golf courses. Waterfowl, especially grazers like geese, prefer easy access to water. Maintaining an uncut vegetated buffer along the shoreline will make the habitat less desirable to geese and encourage migration. In addition, any educational program should emphasize that feeding waterfowl, such as ducks, geese, and swans may contribute to water quality impairments in the Southeast Shoreline watershed and can harm human health and the environment.

Animal wastes should be disposed of away from any waterbody or storm drain system. BMPs effective at reducing the impact of animal waste on water quality include installing signage, providing pet waste receptacles in high-uses areas, enacting ordinances requiring the clean-up of pet waste, and targeting educational and outreach programs in problem areas.

5) Monitor permitted sources.

Currently there are no available sampling data for the permitted discharges in the Southeast Shoreline watershed around Fenger Brook. Further monitoring will provide information essential to better locate, understand, and reduce pollution sources. If any current monitoring is not done with appropriate bacterial indicator based on the receiving water, then a recommended change during the next permit reissuance is to include the appropriate indicator species. If facility monitoring indicates elevated bacteria, then implementation of permit required, and voluntary measures to identify and reduce sources of bacterial contamination at the facility are an additional recommendation. Regular monitoring should be established for all permitted sources to ensure compliance with permit requirements and to determine if current requirements are adequate or if additional measures are necessary for water quality protection.

Section 6(k) of the MS4 General Permit requires a municipality to modify their Stormwater Management Plan to implement the TMDL within four months of TMDL approval by EPA if stormwater within the municipality contributes pollutant(s) in excess of the allocation established by the TMDL. For discharges to impaired waterbodies, the municipality must assess and modify the six minimum measures of its plan, if necessary, to meet TMDL standards. Particular focus should be placed on the following plan components: public education, illicit discharge detection and elimination, stormwater structures cleaning, and the repair, upgrade, or retrofit of storm sewer structures. The goal of these modifications is to establish a program that improves water quality consistent with TMDL requirements. Modifications to the Stormwater Management Plan in response to TMDL development should be submitted to the Stormwater Program of DEEP for review and approval.

Table 8 details the appropriate bacteria criteria for use as waste load allocations established by this TMDL for use as water quality targets by permittees as permits are renewed and updated, within the Southeast Shoreline Watershed.

For any municipality subject to an MS4 permit and affected by a TMDL, the permit requires a modification of the SMP to include BMPs that address the included impairment. In the case of bacteria related impairments municipal BMPs could include: implementation or improvement to existing nuisance wildlife programs, septic system monitoring programs, any additional measures that can be added to the required illicit discharge detection and elimination (IDDE) programs, and increased street sweeping above basic permit requirements. Any non-MS4 municipalities can implement these same types of initiatives in effort to reduce bacteria source loading to impaired waterways.

Any facilities that discharge non-MS4 regulated stormwater should update their Pollution Prevention Plan to reflect BMPs that can reduce bacteria loading to the receiving waterway. These BMPs could include nuisance wildlife control programs and any installations that increase surface infiltration to reduce overall stormwater volumes. Facilities that are regulated under the Commercial Activities Stormwater Permit should report any updates to their SMP in their summary documentation submitted to DEEP.

Table 8 Bacteria (e.coli) TMDLs, WLAs, and LAs for Recreational Use

Class	Bacteria Source	Instantaneous <i>E. coli</i> (#/100mL)						Geometric Mean <i>E. coli</i> (#/100mL)	
		WLA ⁶			LA ⁶			WLA ⁶	LA ⁶
	Recreational Use	1	2	3	1	2	3	All	All
A	Non-Stormwater NPDES	0	0	0				0	
	CSOs	0	0	0				0	
	SSOs	0	0	0				0	
	Illicit sewer connection	0	0	0				0	
	Leaking sewer lines	0	0	0				0	
	Stormwater (MS4s)	235 ⁷	410 ⁷	576 ⁷				126 ⁷	
	Stormwater (non-MS4)				235 ⁷	410 ⁷	576 ⁷		126 ⁷
	Wildlife direct discharge				235 ⁷	410 ⁷	576 ⁷		126 ⁷
	Human or domestic animal direct discharge ⁵				235	410	576		126

- (1) **Designated Swimming.** Procedures for monitoring and closure of bathing areas by State and Local Health Authorities are specified in: Guidelines for Monitoring Bathing Waters and Closure Protocol, adopted jointly by the Department of Environmental Protections and the Department of Public Health. May 1989. Revised April 2003 and updated December 2008.
- (2) **Non-Designated Swimming.** Includes areas otherwise suitable for swimming but which have not been designated by State or Local authorities as bathing areas, waters which support tubing, water skiing, or other recreational activities where full body contact is likely.
- (3) **All Other Recreational Uses.**
- (4) Criteria for the protection of recreational uses in Class B waters do not apply when disinfection of sewage treatment plant effluents is not required consistent with Standard 23. (Class B surface waters located north of Interstate Highway I-95 and downstream of a sewage treatment plant providing seasonal disinfection May 1 through October 1, as authorized by the Commissioner.)
- (5) Human direct discharge = swimmers
- (6) Unless otherwise required by statute or regulation, compliance with this TMDL will be based on ambient concentrations and not end-of-pipe bacteria concentrations
- (7) Replace numeric value with "natural levels" if only source is naturally occurring wildlife. Natural is defined as the biological, chemical and physical conditions and communities that occur within the environment which are unaffected or minimally affected by human influences (CT DEEP 2011a). Sections 2.2.2 and 6.2.7 of this Core Document deal with BMPs and delineating type of wildlife inputs.

BACTERIA DATA AND PERCENT REDUCTIONS TO MEET THE TMDL

Table 9: East River Bacteria Data

Waterbody ID: CT2000-30_01**Characteristics:** Freshwater, Class A, Existing or Proposed Drinking Water Source, Habitat for Fish and other Aquatic Life and Wildlife, Recreation, and Industrial and Agricultural Water Supply**Impairment:** Recreation (*E. coli* bacteria)**Water Quality Criteria for *E. coli*:**

Geometric Mean: 126 colonies/100 mL

Single Sample: 410 colonies/100 mL

Percent Reduction to meet TMDL:

Geometric Mean: 7%

Single Sample: 62%

Data: 2000-2001 from CT DEEP targeted sampling efforts, 2012 TMDL Cycle**Single sample *E. coli* (colonies/100 mL) data from all monitoring stations on Fenger Brook with annual geometric means calculated**

Station Name	Station Location	Date	Results	Wet/Dry	Geomean
248	Route 213 and 3 foot stone dam	10/19/2000	63	wet**	NA
248	Route 213 and 3 foot stone dam	2/22/2001	10 [†]	dry	136*(7%)
248	Route 213 and 3 foot stone dam	5/8/2001	235 [†]	dry**	
248	Route 213 and 3 foot stone dam	7/31/2001	1080 ^{†*} (62%)	dry	

Shaded cells indicate an exceedance of water quality criteria

[†] Average of two duplicate samples

** Weather conditions for selected data taken from Hartford because local station had missing data

*Indicates single sample and geometric mean values used to calculate the percent reduction

Wet and dry weather geometric mean values for all monitoring stations on Fenger Brook

Station Name	Station Location	Years Sampled	Number of Samples		Geometric Mean		
			Wet	Dry	All	Wet	Dry
248	Route 213 and 3 foot stone dam	2000-2001	1	3	112	NA	136

Shaded cells indicate an exceedance of water quality criteria

Weather condition determined from rain gages in Groton, CT and at Hartford Bradley International Airport

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